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ABSTRACT

Whole-class peer tutoring programs have been found by some to be an effective way of providing students with a one-to-one instructional setting. This document reports on a study in which a peer tutoring program on mathematics fact acquisition was assessed using a second grade classroom consisting of 21 learners who possessed below average mathematical ability. The program was designed to improve students' speed and accuracy in responding to addition facts both orally and in writing. A partner flashcard procedure was used along with the implementation of written speed tests. The results indicated that peer teaching significantly increased students' knowledge of mathematics facts both orally and on written speed tests. All of the students increased the percentage of addition facts, as measured by pre and post tutoring tests. All but one student greatly improved in his/her ability to pass written speed tests with 100 percent accuracy. (Author/TW)

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Improving Math Performance Through a Peer Tutoring Program

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Running head: PEER TUTORING PROGRAM

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Abstract

The effects of the Peer Tutoring Program on math fact acquisition was assessed with a second grade classroom consisting of twenty-one learners of below average mathematics ability. The program was designed to improve students' speed and accuracy in responding to addition facts both orally and in writing. A partner flashcard procedure was used along with the implementation of written speed tests. It was demonstrated that the peer tutoring significantly increased students' knowledge of math facts both orally and on written speed tests. All students increased the percentage of addition facts they knew, as measured by the pre and post tutoring tests. All but one student greatly improved in his/her ability to pass written speed tests with 100% accuracy.

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The Effects of an Intensive Tutor Training Component in a Peer Tutoring Program

Special education and regular classroom teachers alike are continually looking for programs and techniques designed to meet the individual needs of students (Pierce & Van Houten, 1985). Whole-class peer tutoring programs have been found to be an effective and efficient way of providing students with a one-to-one instructional setting (Delquadri, Greenwood, Stretton & Hall, 1983; Cooke, Heron & Heward, 1983).

One important component for successful peer tutoring programs is a thorough tutor training procedure (Pierce, Stahlbrand & Armstrong, 1984). Recently a training program based on an outcomes-based instruction approach was designed and implemented in an elementary school. The training focused on ten specific skills with much review and practice. The program consisted of ten days of training (approximately 30 minutes each day) with emphasis on the necessary academic skills and also pertinent social skills.

METHOD

Students and setting

The students were 21 children (8 boys and 13 girls) attending a homogeneously grouped math class which met every day for 35 minutes. These students were a mixture from the

five second grades in the school and comprised the "low average" math class. All but one student scored below the 40th percentile on the Comprehensive Test of Basic Skills in Math and were eligible for the Chapter 1 program.

The peer tutoring program was implemented by the Chapter 1 teacher in cooperation with the regular classroom teacher and took place three days a week during the first 15 minutes of each class period. On the three designated days, the students picked up their tutoring folders from the box at the front of the room as they came into math class. Students who were already in the room (there were five in the homeroom class) picked up their folders as the rest of the students left the room. Students then went to their desks, which were arranged in pairs facing each other throughout the room. When all students were seated with their folders, the timer was set for 15 minutes and students began the flashcard procedure. As they finished, they quietly put their folders back in the box. When the bell rang, all students were required to stop tutoring and immediately put all materials away.

At the end of the three tutoring days, the teachers went through each student's folder and checked their record-keeping sheet and happy/sad face reinforcement sheet. If students had colored in at least 2 out of their 3 happy faces for the week, they received a rubber stamp on their folder. When they had earned 3 stamps, they could chose a

sticker to put up on the tutoring chart posted in the classsroom.

The teachers then prepared the folders for the following week. This involved pulling out the flashcards that had been mastered (3 consecutive plusses on record-keeping sheet) and replacing them with new cards. Any cards that had not been mastered remained in the folder for the following week. Each student had their own complete set of flashcards (addition sums to 10) which the teachers kept and took cards from each week. A sheet with all the facts listed and data on mastery was kept in each student's folder and was used to keep track of the flashcards.

Speed tests were introduced halfway through the study in order to prepare students for a State Competency. This competency requires students to be able to complete a written addition speed test of 100 facts (sums to 18) in 3 minutes by grade 8. The tests in this study were administered 3 times weekly and began with 33 facts (sums to 10) which were to be completed in 2 minutes with 100% accuracy. The goal was to have all students complete 33 facts in 1 1/2 minutes with 100% accuracy.

This article will focus on the tutor training component which the authors feel made a significant difference in the quality of the program.

Tutor training

The first day of the training began with a discussion of the term "tutor" and an overview of tutoring and teaching. Students were told that they would all have a chance to be tutors/teachers during their math class. The importance of their job was emphasized and most students became immediately excited and eager to begin.

Tutor Training Components

Day 1

Once the interest was sparked, the stage was set for the rest of the training which began with the first training objective -- Establish rapport with the tutee. A poster was displayed on the blackboard with this objective stenciled on it and the students enjoyed learning the meaning of and using "adult words" in the discussion. The importance of this skill was explained to students and the classroom teacher and Chapter I teacher demonstrated through role-playing how one goes about establishing rapport with his/her partner. Students were then asked to chose a partner and practice getting acquainted. During this activity and all other skill practicing, the teachers walked around the room to monitor and guide students as necessary.

Day 2

The second day of the training began with a review of Skill #1. Objectives 2, 3, and 4 were then introduced --

Give Clear Instructions, Secure the Tutee's Attention and Stay On Task.

The importance of giving clear instructions was demonstrated through an activity where students were given a blank sheet of paper and a set of vague oral directions. Their confusion was immediate and the result was a good class discussion centered on what went wrong and why. Students laughed when told they'd have to learn to do a better job than the teacher had done. The guided practice that followed was an activity similiar to the above where students had to be very specific with their directions.

The last 10 minutes were spent talking about ways to secure their partner's attention and how to stay on task. Students were asked to think of things they might say to their partner if they were not paying attention and how they might make sure that the task gets done.

Day 3

Day three of the training began with a review of skills 1-4. The posters for these skills were displayed on the board and left there. Posters for Objectives 5, 6 and 7 were then put up and the training began for these skills -- Praise the Tutee For a Correct Response, Demonstrate the Proper Correction Procedure for an Incorrect Response and Avoid "Put-Downs."

Students were told that they were now ready to begin practicing "real" teaching. Their excitement was obvious.

A discussion about praise and "put-downs" was held. Specific phrases for each were brainstormed and listed on the blackboard. A poster was then made and displayed in the room. (See Figure 1).

Insert Figure 1 about here

A demonstration of Skills 5 and 6 followed. Teachers modeled how to hold the flashcards, how to praise and how to correct. Put-downs were avoided and students were asked many questions throughout the demonstration. Students whispered to each other "I can do that" and "When can we start?" The class was ended by telling them that the next day they would get to practice these skills with a partner.

Day 4

The fourth day of the training began with a review of previous skills. The review was quick because students were eager to practice Skills 5, 6 and 7. Students were chosen to role-play with the teacher and then with each other in front of the class to ensure that the procedure was followed properly. They were then assigned a partner and practiced using sample flashcards. They were reminded to use all the skills they had learned thus far (1-7). As math class ended there was much chatter and energy throughout the room as students realized that they were actually teachers that day.

Day 5

Day 5 began by reviewing the seven posters on the board and one student commented that there were only "three more to go." At that point the poster for Skill 8 was displayed -- Keep Accurate Records.

Day 6

A student volunteer was chosen to come to the front and role-play with the teacher. The record-keeping chart was introduced and the importance of keeping accurate records was stressed. A sample chart was drawn on the blackboard and as the student went through the flashcard procedure (incorporating Steps 1-7), the teacher filled in the data on the chart. The students then received sample charts and were asked to fill in the data as the procedure was repeated. (See Figure 2).

Insert Figure 2 about here

The students then had an opportunity to work with a partner at their desks. Much guidance and feedback was provided for them during this practice session.

Day 7

On Day 7 of the training all the skills learned so far were reviewed. Students read the posters and gave explanations for each. They were impressed by their ability to read all the "adult words." Their teachers were quite

impressed, too, especially with the quality of their explanations.

Day 8

On the eighth day, Skill 9 was introduced -- Use a Consistent Reward System. The poster was displayed and a discussion about rewards ensued. Students talked openly about rewards they had received and how it felt to be rewarded. The reward system for peer tutoring (which involves students coloring in either a happy or sad face each day at the end of the tutoring session, depending on whether they fulfilled the requirements) was explained. At the end of the week, two or more happy faces earned them a stamp on their folder and every third stamp they were rewarded with a sticker to put on the chart on the door.

The practice for this skill involved providing students with hypothetical tutoring situations and having them decide whether the partners colored in a happy or a sad face. The students then earned a stamp if they did this correctly.

Day 9

Day 9 began with a review of Skills 1-9 and then the final skill was introduced -- Organize Materials.

The proper organizational set-up of all the tutoring materials was demonstrated to the student and a diagram for this drawn on the board. Students were shown how to pick up their folders from the box and how to arrange the material on their desk. They were then asked to pick up their

folders and arrange their materials, first using the diagram on the board and then without it. The students proceeded quickly and were excited to finally get to see their folders (colorful 2 pocketed commercially produced folders).

Day 10

The final day of the training was anxiously greeted by the students. A review of all 10 skills came first and then a closure activity followed where students discussed what the word tutor now meant to them and talked about what they had learned. They were then asked to sign their contracts, agreeing to follow the procedures to the best of their ability. (See Figure 3).

Insert Figure 3 about here

Reliability

Reliability checks were done in two ways. At the end of the third day of peer tutoring, the teachers called individual students to their desks with their folders. The teachers went through the flashcard procedure with each student's facts for that week, checking for discrepancies in the partners record-keeping.

As a second reliability check the two teachers independently examined the record-keeping sheets and compared the data. The agreement was 100% on all occasions.

RESULTS

The mean weekly addition facts, sums to 10, learned by each of the students is shown in Figure 4. The students were assigned 5 addition flashcards weekly and mastery was determined by three consecutive correct responses. The mean number of facts learned weekly by the entire class was 3. Figure 5 shows the weekly number of facts learned by two individual students (student number 13 and 18 from Figure 4).

Figure 6 shows the percentage of addition facts known by each student as measured by an oral flashcard pre and posttest administered by the teacher. 86% of the students mastered 80% or more of the 66 facts presented during the program. The mean pretest percentage for the clas was 46. The mean posttest percentage for the clas was 90.

As a Vermont State Competency, students, by grade 8, are required to answer orally or in writing 100 addition facts of sums to 18 in three minutes. In preparation for this, students in this class took written speed tests three times weekly. The goal was for the students to be able to achieve 100% mastery on a written test requiring them to answer 33 facts of sums to 10 in 1 1/2 minutes. All students were started at 2 minutes and when 100% mastery was achieved on three separate occasions, the 1 1/2 minute time limit was imposed (see Figure 7). On the first test at 2

minutes, 43% of the class achieved 100%. Approximately one month later, all but one student (95%) achieved 100% mastery on three occasions. By the end of this study, 71% of the class had achieved the goal of 33 facts in 1 1/2 minutes on three separate trials.

DISCUSSION

The teachers conducting this study felt that the program's success was largely due to the quality of the training component. The capability and confidence of the students was notably higher than in past years. The role of the teachers during the peer tutoring evolved from that of instructors to that of facilitators. Because students were well prepared and competent, less teacher time was spent engaged in instruction and correction procedures than noted in the past. As a result, more time was available for observations, guidance, and the provision of positive feedback.

The results suggest the effectiveness of the peer tutoring program in increasing the speed and accuracy of responses on written speed tests. Not only were students able to respond speedily (within 3 seconds) and accurately to math facts presented on flashcards by their tutor(s) and teachers(s), but their written responses improved as well.

Peer tutoring in this classroom offered several advantages. First, it provided the teachers with a

systematic, consistent method for monitoring student progress, both daily and weekly. Student record-keeping charts clearly indicated to the teachers the facts that had been mastered by each student and the ones that had not. This served to streamline the record-keeping done by the teachers.

A second advantage of using peer tutoring in this classroom was that it enabled the teachers to spend less time with whole class addition drill work during the regular class time. Because students were practicing their math facts during peer tutoring and experiencing high success rates with the facts orally and on written speed tests, the teachers found that they were able to cover more of the other math curriculum skills than in past years.

Third, the program could be carried out using teacher-made materials to supplement the regular math curriculum at a relatively small expense. Once the packets of flashcards were made (with help from parent and student volunteers) for each student, little additional time and expense went into materials for the rest of the program.

A fourth advantage of peer tutoring relates to the affective component of learning. Students were excited about coming to math and this excitement continued throughout the entire school year. On several occasions, it was necessary to cancel math class due to special school programs and students openly expressed their disappointment

to their teachers and friends. Several parents commented to the teachers that their children were excited about peer tutoring and talked about it at home.

Friendships and mutual bonds were formed between students whose rapport seemed unlikely to develop through other means. There were a few shy students who "came out of their shells" during interaction with their partners and their homeroom teachers noted that this carried over into their classroom with other peers.

Because students work at their own pace, it is possible and desirable to mainstream handicapped students in a whole-class peer tutoring program. Along with the social skills acquired, the mainstreamed student can proceed comfortably with the individualized self-paced packet of flashcards. The teacher can carefully monitor their progress without the need for separate instructional materials.

The classroom in this study provided an optimal environment for team-teaching, since all but one student was Chapter 1 eligible. The teachers chose an in-class delivery model for Chapter 1 services for this reason. Along with the supplemental materials and instruction provided by the Chapter 1 teacher, the peer tutoring program offered an effective way of organizing services in order to provide for these students' individuals needs. Because the peer tutoring was in addition to regular classroom instruction,

Chapter 1 services were a supplementation, rather than a supplanting of instruction, which is the design of the Chapter 1 program.

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Figure Captions

Figure 1. Student record-keeping chart

Figure 4. Mean number of addition facts (sums to 10) learned weekly by each student after 14 weeks of peer tutoring

Figure 5. Sample of number of addition facts learned weekly by 2 students during the 14 week study

Figure 6. Percentage of addition facts (sums to 10) known pre and posttest

Figure 7. Students achieving 100% on written speed tests at 2 minutes and 1 1/2 minutes

Vermont Basic Competency: Given 100 addition facts of sums to 18, students will complete the test, orally or in writing, within 3 minutes, with 100% accuracy by grade 8.

PRAISE

THAT'S TERRIFIC!

NICE GOING!

SUPER!

GREAT JOB!

I LIKE HOW YOU DID THAT!

ALRIGHT!

WAY TO GO!

FANTASTIC!

WONDERFUL!

AWESOME!

TUTEE: _____

+ = CORRECT

0 = INCORRECT

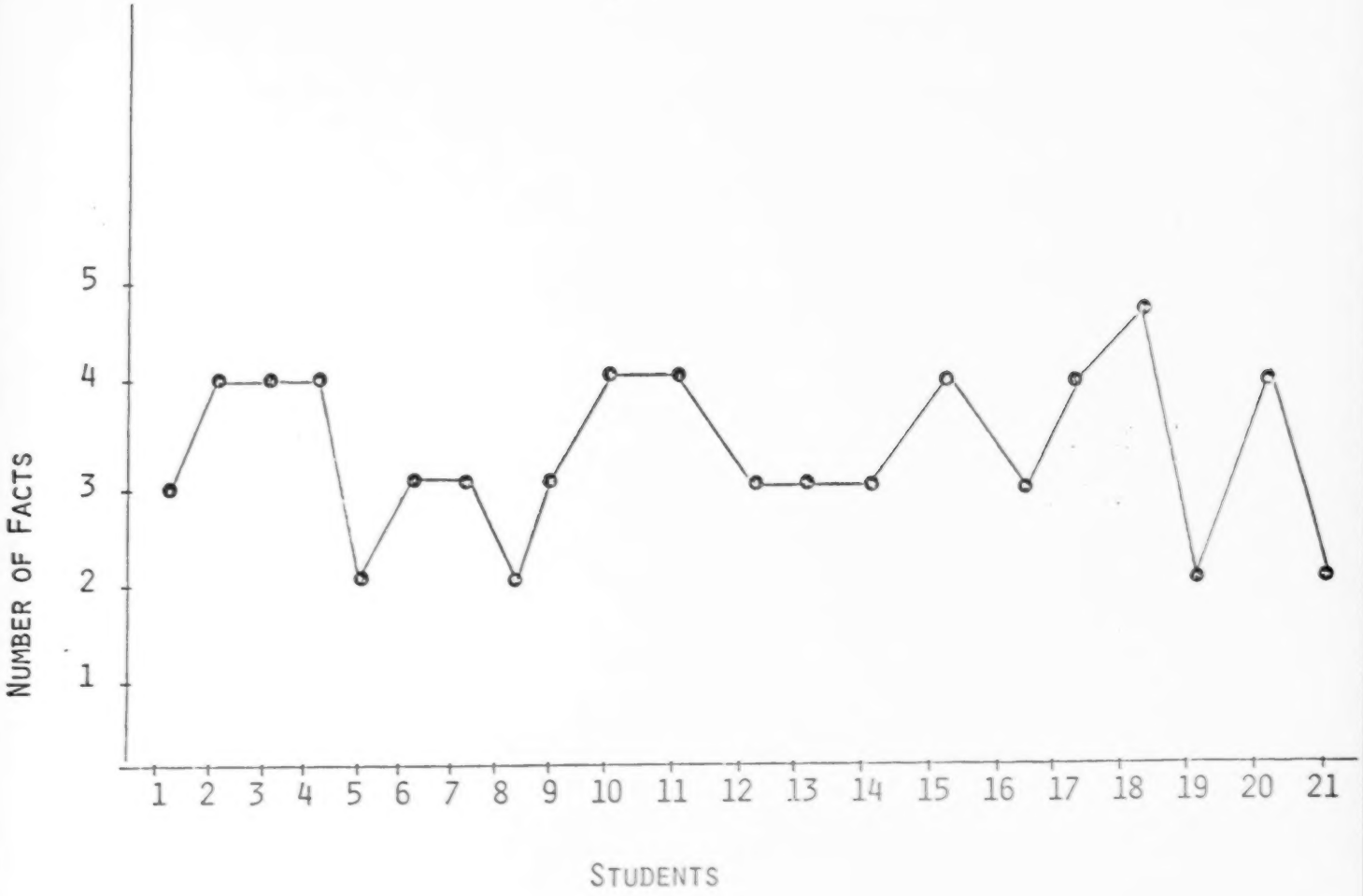
	SESSION 1			SESSION 2			SESSION 3		
FACT	DATE:			DATE:			DATE:		

Tutoring Contract

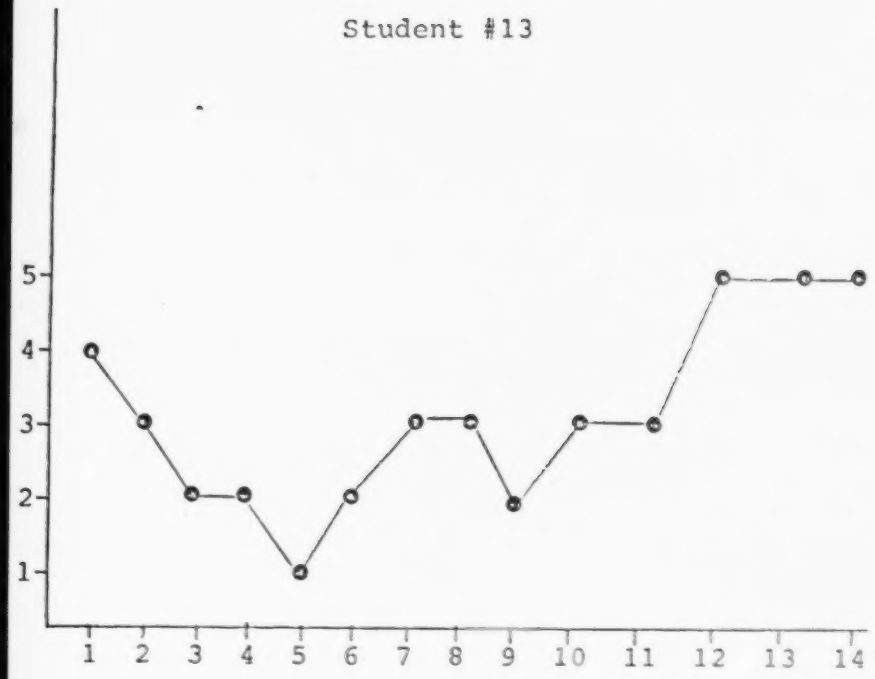
I, _____ agree to take part in the peer tutoring program in my math class at City School. I will work with my partner and follow the rules that have been set up by my teachers.

Date:

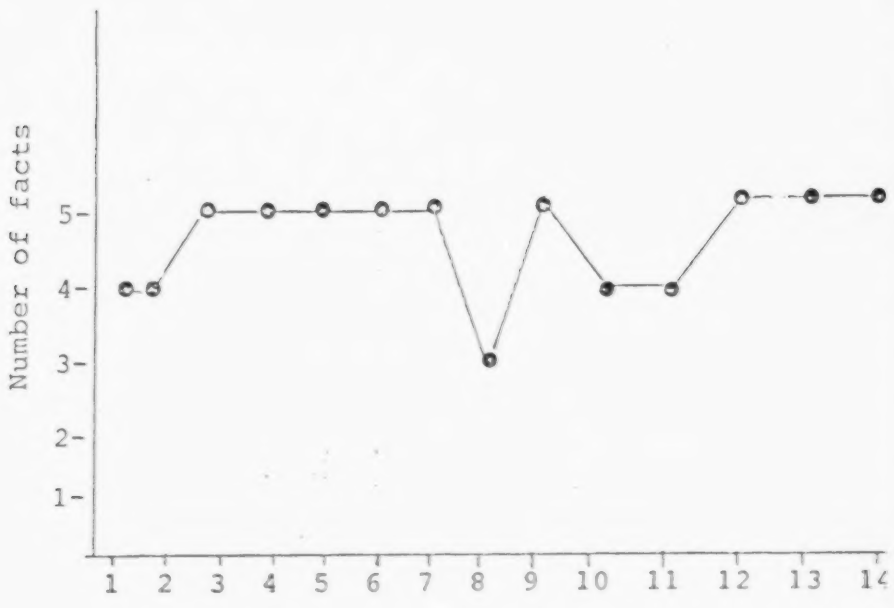
Signature:

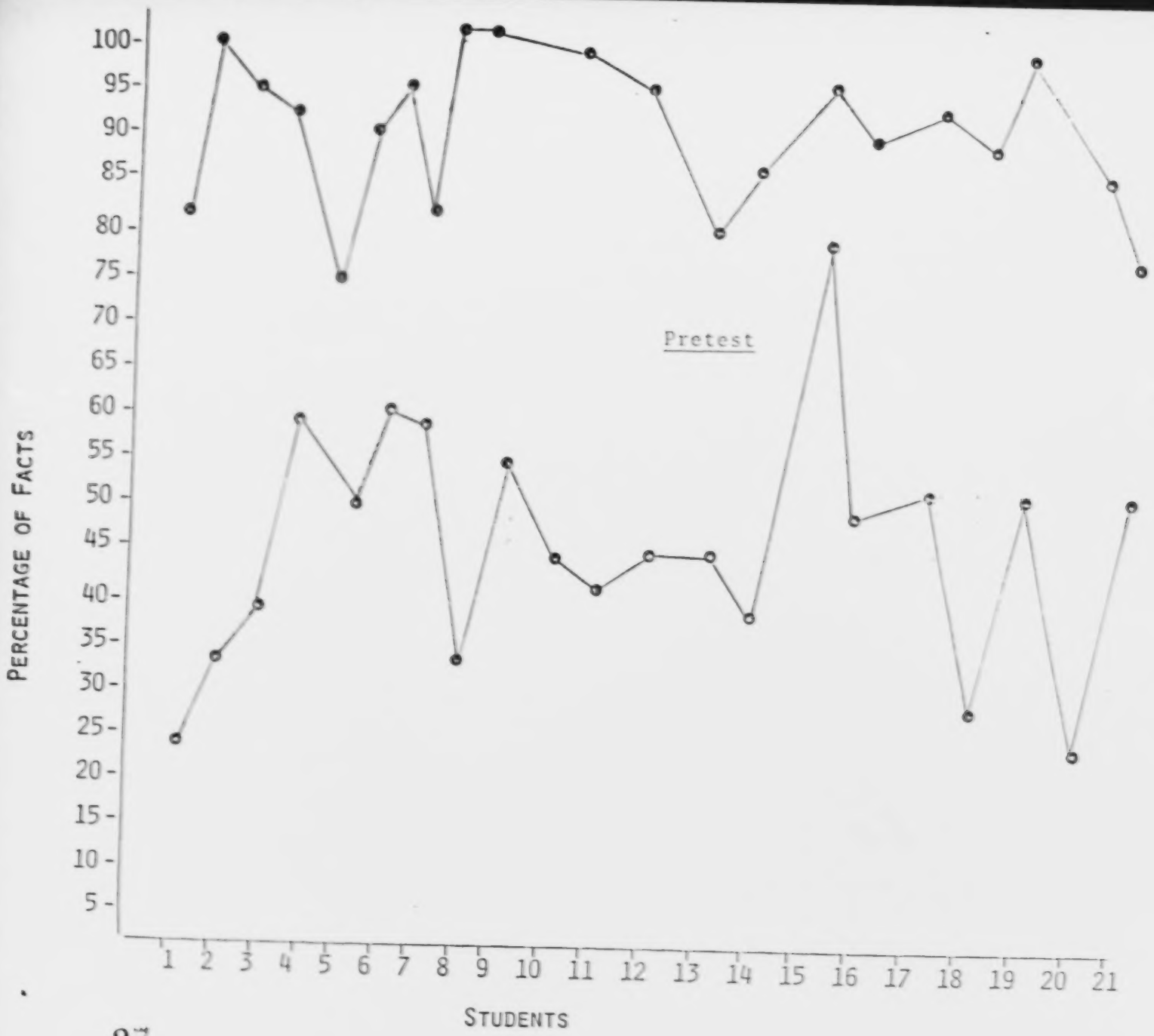

NUMBER OF FACTS
5
4
3
2
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
STUDENTS

Student #13



Student #18




100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
PERCENTAGE OF FACTS
Pretest
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
STUDENTS

STUDENTS	33 Facts 2 min.			33 Facts 1 1/2 min.		
1	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓	✓
6	✓	✓	✓	✓	✓	✓
7	✓	✓	✓	✓	✓	✓
8	✓	✓	✓	✓	✓	✓
9	✓	✓	✓	✓	✓	✓
10	✓	✓	✓	✓	✓	✓
11	✓	✓	✓	✓	✓	✓
12	✓	✓	✓	✓	✓	✓
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15	✓	✓	✓	✓	✓	✓
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19	✓	✓	✓			
20	✓	✓	✓	✓	✓	
21	✓	✓	✓			
	95%			71%		